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Parabolic Flight Evaluation of Bacterial Adhesion on Multiple Antimicrobial Surface Treatments

This report describes the development of a test method and the evaluation of the effectiveness of antimicrobial technologies in reduced gravity based on parabolic flight experiments. Microbial growth is a common occurrence on fully immersed wetted surfaces in spacecraft environmental control and life support systems despite the use of chemical and/or physical disinfection. Many materials and surface treatments with antimicrobial properties are commercially available but none have been vetted for spaceflight applications. Herein a test method is explained that included ground and reduced gravity parabolic flight experiments with a standard microorganism recovered from spacecraft, *Pseudomonas aeruginosa*, added at a concentration of 1×10^5 cells per milliliter (mL) onto challenge material coupon surfaces. Several experimental materials were observed to slightly reduce microbial attachment in reduced gravity flight experiments, but none were capable of eliminating all challenge bacteria. Lunar gravity had an increased antimicrobial effect in 28 out of 36 test coupons compared to microgravity when provided otherwise identical conditions for growth, suggesting trace amounts of gravity may be required for maximum antimicrobial performance. Bacterial cells exposed to variable gravity had more than twice as much intracellular adenosine triphosphate (ATP) when compared to control cells exposed only to Earth gravity due to a short duration response to environmental stress. An ATP luminescence assay was the method most amenable to development of an in-flight microbial monitoring assay.